

## **What is claimed is:**

- [Claim 1]** 1. A heterojunction bipolar transistor comprising:
- a semiconductor substrate of a first conductivity type including a collector region;
  - a base region formed on said substrate;
  - an emitter region formed over said base region; and
  - at least one of said collector, base and emitter regions including a first region doped with an impurity having a first concentration and a second region doped with said impurity having a second concentration.
- [Claim 2]** 2. The heterojunction bipolar transistor of claim 1, wherein said base region comprises SiGe.
- [Claim 3]** 3. The heterojunction bipolar transistor of claim 1, wherein said first concentration is less than said second concentration.
- [Claim 4]** 4. The heterojunction bipolar transistor of claim 1, wherein said emitter region comprises said first region doped with a dopant having a first concentration and said second region doped with said dopant having a second concentration greater than said first concentration.
- [Claim 5]** 5. The heterojunction bipolar transistor of claim 4, wherein said first region is formed closer to an emitter–base junction region than said second region.
- [Claim 6]** 6. The heterojunction bipolar transistor of claim 1, wherein said base region comprises said first region doped with a non–dopant having a first concentration and said second region doped with said non–dopant having a second concentration greater than said first concentration.

**[Claim 7]** 7. The heterojunction bipolar transistor of claim 6, wherein said first region is formed closer to an emitter–base junction region than said second region.

**[Claim 8]** 8. The heterojunction bipolar transistor of claim 1, wherein an impurity concentration profile of said first or second regions comprises a step profile or a graded profile.

**[Claim 9]** 9. A heterojunction bipolar transistor comprising:

a semiconductor substrate of a first conductivity type including a collector region;

a base region formed on said substrate including a first base region doped with a non–dopant having a first concentration and a second base region doped with said non–dopant having a second concentration; and

an emitter region formed over said base region including a first emitter region doped with a dopant having a first concentration and a second emitter region doped with said dopant having a second concentration.

**[Claim 10]** 10. The heterojunction bipolar transistor of claim 9, wherein said base region comprises SiGe.

**[Claim 11]** 11. The heterojunction bipolar transistor of claim 9, wherein said first base region and said first emitter region are formed closer to an emitter–base junction region than said second base region and said second emitter region.

**[Claim 12]** 12. The heterojunction bipolar transistor of claim 9, wherein said non–dopant comprises carbon.

**[Claim 13]** 13. The heterojunction bipolar transistor of claim 11, wherein said first carbon concentration is from about  $8 \times 10^{18} \text{ cm}^{-3}$  to about  $5 \times 10^{19} \text{ cm}^{-3}$ , and said second carbon concentration is from about  $1.5 \times 10^{19} \text{ cm}^{-3}$  to about  $7 \times 10^{19} \text{ cm}^{-3}$ .

**[Claim 14]** 14. The heterojunction bipolar transistor of claim 9, wherein said dopant comprises arsenic.

**[Claim 15]** 15. The heterojunction bipolar transistor of claim 14, wherein said first arsenic concentration is from about  $5 \times 10^{19} \text{ cm}^{-3}$  to about  $3 \times 10^{20} \text{ cm}^{-3}$ , and said second arsenic concentration is from about  $1 \times 10^{20} \text{ cm}^{-3}$  to about  $7 \times 10^{20} \text{ cm}^{-3}$ .

**[Claim 16]** 16. A method of fabricating a heterojunction bipolar transistor comprising the steps of:

- providing a semiconductor substrate of a first conductivity type including a collector region;
- forming a base region on said substrate;
- forming an emitter region over said base region;
- doping a first region of at least one of said collector, base and emitter regions with an impurity having a first concentration; and
- doping a second region of said at least one of said collector, base and emitter regions with said impurity having a second concentration.

**[Claim 17]** 17. The method of claim 16, wherein said first region is formed closer to an emitter–base junction region than said second region.

**[Claim 18]** 18. The method of claim 16, wherein said first concentration is less than said second concentration.

**[Claim 19]** 19. The method of claim 16, wherein said steps of doping said first and second regions of said emitter region comprises depositing a first emitter polysilicon layer and a second emitter polysilicon layer.

**[Claim 20]** 20. The method of claim 16, wherein said steps of doping said first and second regions of said base region comprises:

incorporating said impurity in a gas phase in a deposition process; and  
varying an amount of said impurity gas during said deposition process to provide said first and second concentrations.